

An Iterative Technique for Requirement Elicitation in Global Software Development

Nuzhat Sultana, Nayyar Iqbal

Abstract— The purpose of the research is to solve those ambiguities which arise when requirements gathering are conducted globally. In the global software development there are unique challenges for developers and system users across national, cultural, political and language barriers. The most important challenge in the global software development is the selection of an appropriate technique and how the change management process can be applied because the technology is transforming day by day. There is a need that software engineers must be free and open to choose the requirement elicitation techniques and applicable changes can be made any time. This research made comparison between requirement elicitation techniques. The quantitative approach was used by processing online survey and interview and on the basis of these findings we will be able to find out that how the requirements should be gathered and some suggestions also been given to improve the process.

Index Terms— GSD, technological transformation, cost reduction, global access to the market, requirement elicitation,



1 INTRODUCTION

Requirement elicitation is recognized as an earliest and most imperative phase of the many requirements engineering process. The realization of the requirements elicitation accomplishment gives high impact on the achievement of the goals that are pre-defined for Requirement Engineering (RE) which leads to the development of accurate application. Hence, the development of any application is requisite from incorporating good practices of requirements elicitation which usually done in the initial phases (Kasirun, 2005).

It is found that wrong requirement elicitation may lead a failure so most of the errors can be rectified during the implementation phases but it seems too difficult. This is basic significant point where system analyst should pay attention and in this way situation become more complex when requirement gathering done globally and there are numerous challenges for the developers like time zones, language barrier. Social and ethnanic should also not be ignored.

The researchers have tried to overcome these issues by their different contribution but there was not an appropriate method where technique should be selected and how the requirements should be gathered to minimize the risk of system failure by avoiding conflict and barriers.

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2 Background Study

Requirement elicitation is nontrivial because we are never sure that either we have gathered all the desired requirements from the system users. So requirement elicitation is an important milestone and landmark in requirement engineering process.

System engineers should be very sensitive and proactive while gathering the requirements because it is obvious from the history that global software development has well-built effects on the technique the products are selected, evaluated, designed and finally distributed to the customer. So it is the basic and foremost duty of the software engineer that he will be conscious and sensitive which collecting the requirements (Herbsleb and Moitra, 2001).

The quality of the requirement is always affected by the techniques which we applied during elicitation process because it is all about learning the needs and demands of the stakeholders. It is important to know that a single mistake can leads towards a great disaster. How we choose a suitable elicitation approach from the group of available technique which greatly affect the success or failure of requirement elicitation process (Hickey and Davis, 2002).

The researchers claimed that in order to be successful in global software development, developer's needs to learn and become skilled in communication. They can communicate with other countries effectively and efficiently without involving any barriers and conflicts like language barriers, social, political issues and time zones are different. The varied and isolated knowledge also brings

challenges for teams working on GSD projects (Smite *D.*, 2014).

Requirement Elicitation is the process of collecting or gathering the need, demands and expectation of the stakeholders. It is basically consist of chain of process which interacts with each other for further documentation (Chang and Lung, 2002).

It involves all the steps which are taken for the elicitation session. First of all the major task is identify the system stakeholders and plan a questions which needs to be asked then ask the questions and record the answers for further process. Then the major step involved is the selection of an appropriate technique then finally confirm the understanding of the requirements with the system stakeholders.

There are Conversational, Observational, Synthetic and analytical methods and under these methods modern and elderly elicitation techniques lies like Conversational Methods includes interview, questionnaire and survey and Observational Methods are used to explore tacit requirements which are easy to observe but seems to be difficult to speak. It includes social analysis and ethnography. Synthetic Methods these are methods which are combined logically and act as whole methods. It includes Join application Development, Scenarios and passive story boards and finally there are Analytical Methods and these are the methods which based about prior knowledge like demands collected and compared with the existing knowledge and existing documentation. It includes content analysis and existing documentation review.

There are number of techniques which may act as communication and requirement gathering tool but its depends upon the situation, business context and demands of the user. But an analyst always tries to select those techniques which are best for their project (Zowghi and Collin, 2005).

Interview: It is the mainly used and an effective technique for elicitation of necessities. Interviews can be designed or structured or spontaneous and unstructured depends on the situation. It is necessary to mention that interviews always depend upon the communication skills and body language on the interviewer. It is helpful techniques in the GSD because constructive and huge quantity of data can be collected via a booming interview. It is basically a two way process in which stakeholders and system analyst are key players. (Spanoudakis, 2002).

Questionnaire: This elicitation approach is only used when the project is about to start. It may comprises of number of questions and questions should be in the very beginning. It can only be used in the

very beginning of the project to elicit requirements. Questionnaire and these is comprises of set of questions can be open or closed depending on the type of product to be developed. Researchers assumed that although it is a good activity but respondent has to answer In limited expansion Therefore Questionnaires sometimes are not considered to be an effective technique in GSD because of successful questionnaire depends upon honesty of the respondents, Purpose should be defined and conduction, gathering and analyzing should be in systematic manner.

Brainstorming: It is all about the new ideas and great innovations which depends upon the how requirement should be gathered.. This technique is conducted in a conference way comprises of about six to eight members. Such activity is headed by the organization head and main issues discussed. Then best idea is voted from the group and then that approach is selected as a solution. It is basically informed what actually system should do and what rules are required. It is not a good technique for GSD as all stakeholders cannot be involved.

Protocol Task Analysis: In this approach task are divided and then task are analyzed. The justification behind them is discussed in a loud voice by the team members. This is also not an effective technique for requirement elicitation in global software development.

Prototyping: Prototyping is a main shaping of their system a shaping of the system in user defined set of language. System analyst present a prototype of the system is developed to get feedback from customer regarding the product. It provides graphical user interface of the system and limited set of visual requirements presented. It can be a good approach to use in GSD as customers could be provided with various releases of the product as prototypes to elicit requirements.

Group Work: It is group activity and its basic task is it involves all the stakeholders of the system. But this approach is very much difficult to arrange in GSD because users are at various geographical locations.

Scenarios: It is an appropriate technique to create a relationship between system users and system analyst. In this approach scenarios are given and users understand the context.

Joint Application Development: It is a well structured and planned activity for requirement elicitation. This is almost conducted same as brainstorming. In this techniques users, stakeholders and system analysts are free to discuss the functionalities of the proposed system. It is not a good technique for the GSD

scenarios because all the stakeholders can't be involved in the discussion.

Requirement Reuse: The requirement reuse is common method for requirement elicitation because using the existing demand knowledge makes this technique less costly and not very much time consumes. It is somehow tough to use the requirements again because may be existing requirements will be different from the proposed system.

Observation: This is also known as social analysis. It is a wide process which involves on analysis of the people. In this method system analyst or requirement analyst congregate the requirements by observing the people doing their routine work. This technique is not suitable in the global software development. In the GSD scenario observation can't be made due to geographical distend locations.

3 issues and Challenges in Global Software Development

It has observed that sometimes conflicts are not considered to be effective but in the requirement engineering considered to be important part of software development life cycle. Many researchers claimed that clear and complete understanding of the requirements result to achieve practical and collaborative system achieved. So conflicts between end users, system manager should be resolved first. There are four types of conflicts, interpersonal, intra personal, intergroup and intragroup. Most of the researchers claimed that conflict is not a negative activity but early identification of the conflict and then its resolutions make the development easy. It helps to solve the time and cost. During this negotiation phase divergence should be set on effectively and measures taken to ensure no critical requirements are lost due to poor negotiation skills on the part of the user or analyst (Tunnamem *et al.*, 2003).

The requirement engineer and system stakeholder may have difference of opinions, thoughts, social background, cultural and political issues, time and distance are also an important factors which if ignored becomes obstacles and barriers in the requirement gathering process. As an aid to handling the complexity of cultural challenges, a number of author has specified and catagerogize these issues as follows .There can be language and terminology differences .One word in a language may have different meaning in one country and having another meaning in another country. There are also involved some Islamic sects issues. Many option are banned in Islamic coun-

tries and but allow in Europe and other continents.

Distance is also an important aspect in requirement engineering phase in the GSD. If the customers and stake holder are situated far away then there is a call for to be taken requirement gathering very carefully. Time difference also matters in the requirement gathering process and requirements specification will be blurred and disputed if not solve such conflicts. (Bjarnason *et al.*, 2014).

Strategic issues are long term issues and it helps to decide whether system should be developed or it can be postponed. Because it is very difficult to divide to across multiple sites in remote location and geographical factor cannot be ignored also. Solutions are controlled by existing resources at the sites, their levels of proficiency and capability in various technologies, infrastructure, etc (Damian, 2007).

Technical issues are always there when teams are working across sites, the lack of management can be predominantly critical. There is a dire need to assure commonly distinct landmark and clear entry and exit criteria for all tasks (Damian, 2007).

Political issues can also be a cause in the requirement gathering process some projects cannot be developed in GSD scenario when one political party is not ready to accept this but other one is willing.

4 Proposed Work and Recommendation:

It has been observed that wrong requirement gathering leads the software towards failure and sometimes heavy loss in terms of cost and time may be faced.

To achieve the objective of this research, the following research questions were addressed.

RQ1. How requirements can be gathered in the GSD?

RQ2. What are the communication risks in GSD projects, their caused and effects?

RQ3: What are the most often used methods for requirement

The author has presented a model and this model will help to improve the process of requirement elicitation. This model will assist to make the requirement unambiguous and clear. We have almost discussed all the relevant techniques and their outcome also. We have divided the proposed solution in two phases. In this first phase system analyst will gather the requirements and then elicitation process will start. It supposed to be combinational activities of

both system analyst and system stakeholders. System analyst and stakeholders will be in contact until the requirement should be finalized.

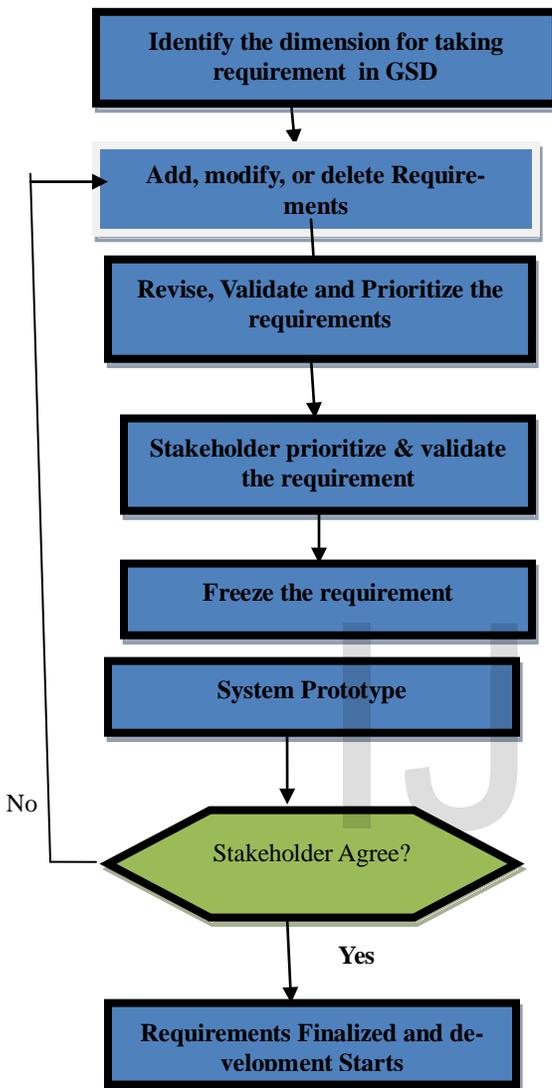


Fig 1: An Iterative Technique for Requirement Elicitation

Elicitation process will start and requirements will be gathered and collected. In this phase system analyst will understand business domain and problem domain. After clear understanding of the requirement and its environment then process will start.

In the third phase the author has proposed a new iterative model for the requirements elicitation, in this model user will explain the requirement and in a every meeting requirement will be gathered and validated and prioritized.

Then System developer will prepare prototype of the model

and then it will verify it from stakeholder or system user. If requirements are not approved then requirements will again be gathered. The author has discussed that although the presented prototype model will increase the budgeted cost but it will reduce and minimize the risk of failure and loss.

The author has also given some verbal suggestion and by following which the communication conflict and barriers which can be avoided.

Requirement should adopt the iterative approach for requirement gathering like requirements should be collected, then categorized and finally should be ranked according to the importance and usage. This process should be iterative until developer will be able to get clear, unbiased and uncomplicated requirements.

Selection and adaption of an appropriate technique should be according to the situation, budget and time constraints.

Software Engineers must be well versed trained to deal with different people with different social background like social context should be updated like what is allowed and don't allowed scenarios.

5 Discussion and Future Work

There are some predefined set of benefits and challenges of global software development because development is always round the clock. The reason for this is different time zones are in every part of the world and this is assumed to be more skilled workers are there global software development Most important challenges are communication, coordination and control.

The author has used qualitative research approach to figure out how professionals overcome the communication barriers and apply the requirement elicitation methods to gather the requirements for large web projects in industry. An online interview and questionnaire procedure is selected for data collection instead of any other available techniques because of time and cost constraints. It helps us in collection of in-depth information of particular questions from geographical distributed respondents. Furthermore, an online interview approach gives us an opportunity to interact and gained knowledge from experienced professionals working in industries.

As we have previously discusses that requirement gathering is very much important and vital because theses involves many barriers and risks. We have deliberately pointed out the main challenges of requirement elicitation in global software development. Now the questions arises how these issues can be resolved and which type of technique should be selected to minimize its risks, challenges, barriers

We have conducted personal interviews with five personnel, working in the different development organizations in Pakistan and India. The purpose of this interview was to identify the possible communication barriers in requirement acquisition process of such projects which developed globally. And find out elicitation method(s) for requirement gathering of these projects. In this chapter, we will present the results of our study and try to answer the research questions based on the findings from this study.

The respondents were asked to convey their views on the significance of requirements engineering. It was interesting to mention that respondents with more knowledge considered that the requirements engineering was an important feature, whereas the starter in the field had very slight idea about the development. This is shown in Figure below.

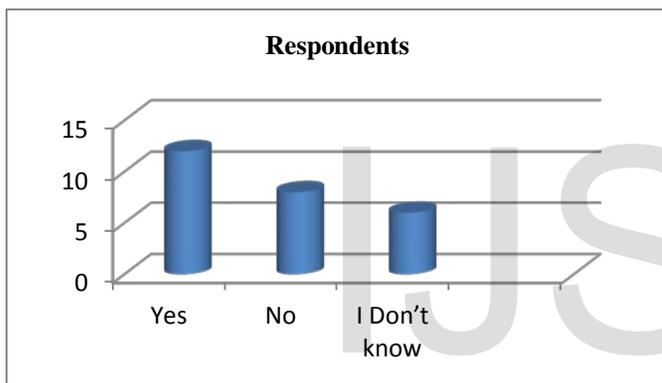


Figure 2: Importance of Requirements

To calculate the effectiveness of the method, question was asked. The respondents who supposed that the requirements engineering was an imperative process answered this question. Then a graph was plot against each method. For each respondent selecting the method, the particular method was incremented by one. Then, this sum was divided by the number of total.

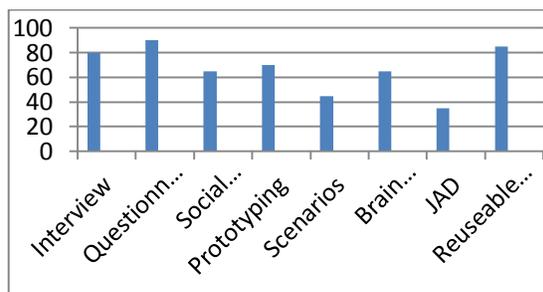


Fig 3: Popularly used requirements elicitation method in industries

The author has observed that in the requirement elicitation process, there are some factors which should not be ignored like User In-

volvement, diagrammatic Representation and Social Context because user involvement will show how much concern the user is and diagrammatic or symbolic representation will help the system user to understand the proposed system easily, Finally social context understanding will help to understand the environment where both parties has to work. The reason for choosing development globally found because of following factors:

Cost Reduction

Availability of experienced persons

Rapid Development Time

Global Access to Market.

Language resource persons should be hired to the language barrier could be eliminated.

Software engineer must record all the discussions which are made between the stakeholder and software engineers.

This research will continue for further study regarding the change management. The author will study how change can be applicable in GSD scenario where users are across the borders and technological transformation is always there.

6 Conclusion

Requirements elicitation is considered to be the first phase of the requirements engineering where analysts draw out information about the problem domain from stakeholders. It is a very composite task because it is process of seeking, shaping, learning, gaining and sometimes re inventing the wheel and explaining the requirements of potential stakeholders. This study has discovered numerous factors that are very important for the whole requirement process. We have given the clear picture of the whole scenario and assumed that situation is becomes very much difficult and complex when system users and stakeholders has to collaborate with each other only specific medium like internet. The author has given some recommendation to improve the process by avoiding conflict and barriers. The proposed suggestions along with its effectiveness also will verify the accuracy and efficiency of the real time software needs to be tested in the project.

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REFERENCES

- [1] Bjarnason, E., K. Smolander, E. Engstorm and p. Runeson . Alignment practices affect distances in software development: a theory and model. *Proceedings of the third workshop on general theories of software engineering*, 84(11): 21-31.2014.
- [2] Chang, P. and S.C. Lung., Organizational Changes for advanced manufacturing technology infusion: *Internal Journal of Management*, 19(2): 206-218.
- Damian D. 2007. Stakeholders in requirement engineering: lessons learned from practice. *Software, IEEE*, 24(2): 21-27. 2002.
- [3] Herbsleb, J.D. and D. Moitra , Global Software Development. *Software Engineering proceedings, IEEE*, 18(2):16-20.2001.
- [4] Kasriun, Z. M., A survey on the requirement elicitation practices among developers, *Malaysian Journal of Computer Science*, 18(1):70-77.2005.
- [5] Zowghi, D. and C. Coulin "Requirements Elicitation: A Survey of Techniques, Approaches, and Tools", Publisher: Springer Berlin Heidelberg 2005, Page(s): 19-46. . 2005.
- [6] Tuunanen, T., P., Nielsen, and N., Mallat., "Stepping Out of the House - Participatory Design with Wide Audience," in *26th Information Systems Research Seminar in Scandinavia (IRIS26)*, Helsinki School of Economics, Haikko, Finland, 2003.
- [7] Spanoudakis, G, Plausible and adoptive requirement traceability structures. *Proceedings of the 14th international conference on software engineering*,. ACM:105-153. 2002.
- [8] Hickey, A. M. and A. M. Davis, The role of requirements elicitation Techniques in achieving software quality. *Foundations for Software Quality* 20(2): 165-171.2006.
- [9] Šmite, D.,Coordination Practices in Global Software Development. *LNCS* 3547(1): 234-35.2005.